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Bibliography

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Epitome

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**(57) [Abstract]**

**[Objects of the Invention]** The plastic lens which prevents effectively transparency of ultraviolet rays and a near infrared ray is obtained maintaining the transmission of a visible ray highly.

**[Elements of the Invention]** While a plastic lens is equipped with a means to regulate infrared transparency, for the average light transmission of a wavelength the region of 200-400nm, the average light transmission of a wavelength the region of 400-750nm is [ the average light transmission of 50% or more, and a wavelength the region of 750-1000nm ] 15% or less 0.3% or less including an ultraviolet ray absorbent. Since infrared transparency is regulated, a lens can be made to contain a dithiol nickel complex salt system infrared absorption agent etc. about 0.001 to 0.1% of the weight. A benzophenone system compound etc. can be used as an ultraviolet ray absorbent. Since according to said plastic lens damage on an eye with a harmful beam of light can be prevented while a bright visual field is acquired, it can be used suitable for the glass lens for eye disease persons etc.

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**CLAIMS**

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**[Claim(s)]**

**[Claim 1]** It is the plastic lens which contains an ultraviolet ray absorbent while having a means to regulate infrared transparency, and, for the average light transmission of 0.3% or less, and a wavelength the region of 400-750nm, the average light transmission of 50% or more, and a wavelength the region of 750-1000nm is [ the average light transmission of a wavelength the region of 200-400nm ] 15% or less of plastic lens.

**[Claim 2]** The plastic lens containing an infrared absorption agent according to claim 1.

**[Claim 3]** The plastic lens according to claim 2 which contains dithiol nickel complex salt as an infrared absorption agent.

**[Claim 4]** The plastic lens according to claim 3 which contains dithiol nickel complex salt 0.001 to 0.1% of the weight.

**[Claim 5]** A polycarbonate, dithiol nickel complex salt, and an ultraviolet ray absorbent are included, and, for the average light transmission of 0.3% or less, and a wavelength the region of 400-750nm, the average light transmission of 50% or more, and a wavelength the region of 750-1000nm is [ the average light transmission of a wavelength the region of 200-400nm ] 15% or less of plastic lens.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to a useful plastic lens, when protecting an eye from the harmful beam of light contained in sunrays.

[0002]

[Description of the Prior Art] The beam of light harmful to an eye is contained in sunrays. For example, the ultraviolet rays which have the wavelength of 400nm or less have a bad influence on a cornea or a lens. When an eye is especially exposed to sunrays in locations with many amounts of ultraviolet rays, such as the sea, for a long time, they are a lifting and a cone about keratitis. Moreover, since accumulative has the influence on a lens, a cataract may be caused.

[0003] Moreover, among infrared radiation, since especially the near infrared ray that has the wavelength of 750-1000nm reaches even the eyegrounds section of an eye, if it acts strongly, it will bring a failure to the iris, a lens, a retina, and a choroid. And since the effect of a near infrared ray appears gradually and accumulative moreover has it, while discovery of inflammation is overdue, inflammation tends to become chronic.

[0004] Therefore, persons with the need of protecting especially an eye, such as eye disease persons, such as retinitis pigmentosa, optic hyperesthesia, \*\*\*\*\*, and contrast \*\*\*\*\*, a person under medical treatment after an eye disease operation, and an old man, need to avoid that the above-mentioned harmful beam of light goes into an eye as much as possible.

[0005] On the other hand, in order to protect an eye from the dazzle of sunlight, pressure of business of the sunglasses is carried out conventionally. However, with the usual sunglasses, said ultraviolet rays and near infrared ray cannot be prevented. And if such sunglasses are used, since the permeability of a visible ray is low, a pupil will open, and it will on the contrary be easy to carry out incidence of the harmful beam of light to an eye.

[0006] In order to prevent transparency of a near infrared ray, the heat ray absorption grading material which made transparence resin contain the reaction mixture which tungsten hexachloride, and phosphoric ester or phosphite is made to react, and is obtained is indicated by JP,3-227366,A. However, in this grading material, if the permeability of a visible ray is held to 50% or more of the high level, the permeability of a near infrared ray will also become high, and if the permeability of a near infrared ray is stopped poorly, the permeability of a visible ray will also become low. Therefore, in this grading material, the permeability of a near infrared ray cannot be controlled poorly, penetrating a visible ray enough.

[0007]

[Problem(s) to be Solved by the Invention] Therefore, the purpose of this invention is to offer a useful plastic lens, when preventing effectively transparency of ultraviolet rays and a near infrared ray and protecting eyes, such as an eye disease person, maintaining the permeability of a visible ray highly.

[0008]

[Means for Solving the Problem] this invention person completed header this invention for the suitable plastic lens for an eye disease person etc., as a result of inquiring wholeheartedly, in order to attain the above-mentioned purpose.

[0009] That is, while this invention is equipped with a means to regulate infrared transparency, it is a plastic lens containing an ultraviolet ray absorbent, and the average light transmission of 50% or more, and a wavelength the region of 750-1000nm offers [ the average light transmission of a wavelength the region of 200-400nm / the average light transmission of a wavelength the region of 400-750nm ] 15% or less of plastic lens 0.3% or less.

[0010] A means to absorb infrared radiation, and a means to reflect infrared radiation are included in a means to regulate transparency of said infrared radiation. In order to absorb infrared radiation, a lens may be made to contain an infrared absorption agent and the coat containing an infrared absorption agent may be formed in a lens front face.

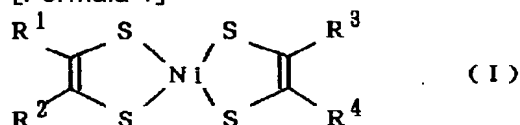
[0011] Without absorbing infrared radiation and spoiling the beam-of-light absorbing power of other absorbents, said infrared absorption agent will not be limited, especially if it is the absorbent which makes the visible ray of a wavelength the region of 400–750nm penetrate. Also in an infrared absorption agent, pressure of business especially of the near infrared ray absorbent is carried out. If a near infrared ray absorbent is used, since the near infrared ray which reaches even the eyegrounds section of human being's eyes will be prevented, the inflammation of a retina etc. can be prevented.

[0012] As a near infrared ray absorbent, for example, cyanine system coloring matter, phthalocyanine system coloring matter, naphthoquinone system coloring matter, anthraquinone system coloring matter, dithiol complex salt, screw (1-mercapto rate-2-naphth rate) quarternary ammonium salt, [3 and 2-thieno b] CHIENIRI DIN bis-benzoquinones, an aminium system compound, a triphenylmethane color system compound, a gene MONIUMU system compound, the second copper of sulfuration, etc. are mentioned.

[0013] Also in these near infrared ray absorbents, the compound in which little and high near infrared ray cutoff ability is shown is desirable, for example, dithiol complex salt, especially dithiol nickel complex salt, etc. are used suitably. As said dithiol nickel complex salt, the compound expressed for example, with the following type (I) can be illustrated.

[0014]

[Formula 1]



In addition, the inside of the above-mentioned formula, R1, R2, R3, and R4 It differs and the same or the aryl group which may have the substituent, a low-grade alkyl group, or a cyano group is shown. Moreover, R1 R2 and R3 R4 With two united carbon atoms, the benzene ring may be formed, respectively. Moreover, when a formula (I) forms an anion, it can be used as a salt with a counter cation.

[0015] A phenyl group, a naphthyl group, etc. are contained in said aryl group. As a substituent which the aryl group may have Alkyl groups, such as methyl, ethyl, propyl, butyl, pentyl, and a hexyl group; Trimethylene, Alkylene groups, such as a tetramethylen radical; Cycloalkyl radical; phenyl groups, such as cyclopentyl and a cyclohexyl radical, The aryl group which may have substituents, such as p-nitrophenyl group; Methoxy, Alkoxy groups, such as ethoxy \*\* propoxy and a butoxy radical; Methylene dioxy, alkylene dioxy radical [, such as an ethylene dioxy radical, ]; -- phenoxy group; -- hydroxyl; -- hydroxymethyl -- Hydroxyalkyl radicals, such as a hydroxyethyl radical; Dimethylamino, Alkylamino radicals, such as diethylamino and a dibutylamino radical; Diphenylamino, arylamino radical [, such as a ditolylamino radical, ]; -- trifluoromethyl radical; -- a methylthio -- The halogen atom of aryl thio radical; nitro group; cyano group; fluorines, such as alkylthio group; phenylthio, such as ethyl thio and a butyl thio radical, and a tolyl thio radical, a bromine, chlorine, and iodine; heterocycle radicals, such as morpholino and 1-pyrrolidinyl radical, etc. are mentioned.

[0016] The alkyl group of the carbon numbers 1–5, such as methyl, ethyl, propyl, isopropyl, butyl, and t-butyl, is contained in said low-grade alkyl group. Said R1 R2 and R3 R4 The benzene ring formed with two united carbon atoms may have the substituent. The substituent which said aryl group may have can be illustrated as this substituent.

[0017] As an example of dithiol nickel complex salt expressed with a formula (I) Screw (1, 2-dipropyl -1, 2-ethylene dithio RATO) nickel, Screw (1, 2-dicyano -1, 2-ethylene dithio RATO) nickel, Screw (1, 2-diphenyl -1, 2-ethylene dithio RATO) nickel, Screw (1, 2-JITORIRU -1, 2-ethylene dithio RATO) nickel, Screw (1, 2-JIKISHIRIRU -1, 2-ethylene dithio RATO) nickel,

Screw (1, 2-JIBIFENIRU -1, 2-ethylene dithio RATO) nickel, Screw [1, 2-screw (2-methoxyphenyl) -1, and 2-ethylene dithio RATO] nickel, Screw [1, 2-screw (4-dimethylamino phenyl) -1, and 2-ethylene dithio RATO] nickel, Screw [1, 2-screw (4-nitrophenyl) -1, and 2-ethylene dithio RATO] nickel, Screw [1, 2-screw (2-chlorophenyl) -1, and 2-ethylene dithio RATO] nickel, Tetrabutylammonium Screw (3, 4, 5, 6-tetra-chloro -1, 2-benzene dithio RATO) nickel, Tetrabutylammonium Screw (3, 4, 5, 6-tetramethyl -1, 2-benzene dithio RATO) nickel, Tetrabutylammonium Screw (4-dimethylamino -1, 2-benzene dithio RATO) nickel, tetrabutylammonium Screw (4-hydroxyl methyl -1, 2-benzene dithio RATO) nickel etc. is mentioned.

[0018] Such dithiol nickel complex salt can be obtained according to the manufacturing method of a publication etc. to JP,3-197488,A.

[0019] Hayes is not produced, even if dithiol complex salt, such as said dithiol nickel complex salt, has the high permeability of a visible ray and it moreover makes it contain in a lens. Therefore, the visual field which became clear brightly is acquired. Moreover, since thermal resistance is very high, a lens substrate and the layer containing an infrared absorption agent are produced separately, it is not necessary to stretch them, and a plastic lens can be industrially manufactured efficiently by very simple approaches, such as the melting fabricating method. said infrared absorption agent -- a kind -- or two or more sorts can be mixed and it can use.

[0020] A means to reflect infrared radiation can consist of vacuum evaporatio film, such as the metal coat formed on the surface of the lens, for example, aluminum, and gold, etc. When forming in a lens the coat which reflects infrared radiation, 300-5000nm of thickness of a coat is usually about 500-3000nm preferably.

[0021] In order to regulate infrared transparency, use of an infrared absorption agent and formation of the layer which reflects infrared radiation may be combined.

[0022] As said ultraviolet ray absorbent, the various compounds which absorb light with a wavelength of 400nm or less can be used. As an ultraviolet ray absorbent, for example, 2-hydroxy-4-methoxybenzophenone, Benzophenone system compound; 2-(2'-hydroxy-5'-methylphenyl) benzotriazols, such as a 2-hydroxy-4-n-octyloxy benzophenone and a 4-dodecyloxy-2-hydroxy benzophenone, 2-(2'-hydroxy-3'-t-butyl-5'-methylphenyl)-5-chlorobenzo triazole, Benzotriazol system compounds, such as 2-(2'-hydroxy-4'-n-octyloxy phenyl) benzotriazol; A phenyl salicylate, p-t-buthylphenyl A SARISHI rate, p-octyl phenyl Salicylic acid derivatives, such as a SARISHI rate; 2-ethylhexyl 2-cyano - 3 and 3-diphenyl acrylate, Ethyl Acrylonitrile system compounds, such as 2-cyano-3 and 3-diphenyl acrylate; resorcinol Mono-benzoate, 2, 4-G t-buthylphenyl Benzoic-acid derivatives, such as 3 and 5-G t-butyl-4-hydroxy benzoate, etc. are mentioned. A benzophenone system compound, a benzotriazol system compound, etc. are contained in a desirable ultraviolet ray absorbent among these.

[0023] It may add in the raw material of a lens, the whole lens may be made to contain said infrared absorption agent and ultraviolet ray absorbent in homogeneity, and the coat formed on the surface of the lens by coating may be made to contain them. Moreover, the coat containing said absorbent may be formed in the interior of a lens as a layer if needed.

[0024] (1) When making a lens contain said absorbent, the amount of the infrared absorption agent used changes with the classes, but it is 0.001 - 0.1% of the weight of the whole lens, and when using dithiol complex salt especially as an infrared absorption agent, it is usually about 0.005 - 0.05 % of the weight preferably. That the permeability of a visible ray will tend to fall if there is much amount of the infrared absorption agent used, if conversely few, infrared transparency cannot be prevented effectively.

[0025] the amount of the ultraviolet ray absorbent used -- usually -- 0.01- of the whole lens -- it is about 0.03 - 0.5 % of the weight preferably 10% of the weight.

[0026] Moreover, when forming the coat which contains an infrared absorption agent and an ultraviolet ray absorbent in (2) lenses, the content of the infrared absorption agent in a coat is about 0.5 - 10 % of the weight preferably 0.1 to 25% of the weight, for example. Moreover, the content of the ultraviolet ray absorbent in a coat is about 0.5 - 10 % of the weight preferably 0.1 to 25% of the weight, for example.

[0027] Said coat can be formed by applying the coating agent containing said absorbent and

transparency polymer. As a transparency polymer, the Pori (meta) acrylic polymer, a polycarbonate, polyester, polystyrene, silicone resin, etc. are illustrated, for example.

[0028] 1-20 micrometers of thickness of each of said coat are about 3-10 micrometers preferably, for example. Moreover, 2-30 micrometers of thickness of the whole coat containing said absorbent are about 3-20 micrometers preferably, for example.

[0029] A coat may be one coat formed by applying the coating agent which may consist of two or more layers formed by carrying out sequential spreading of the coating agent containing each absorbent, and contains an infrared absorption agent and an ultraviolet ray absorbent. Moreover, when forming a coat in two or more layers, especially the built-up sequence of each class is not limited.

[0030] It is desirable to make the whole lens contain said infrared absorption agent etc. in homogeneity from points, such as the ease of manufacture.

[0031] In the plastic lens of this invention, the average light transmission of a wavelength the region of 200-400nm is [ the average light transmission of about 50% or more, for example, 50 - 70%, and a wavelength the region of 750-1000nm of the average light transmission of a wavelength the region of 400-750nm ] about 12% or less preferably 15% or less 0.1% or less 0.3% or less.

[0032]  $A/B \geq 3.7$  and the plastic lens which is especially  $A/B \geq 4.0$  are contained in a desirable plastic lens for the ratio (A/B) of the average light transmission (A %) of 400-750nm region, and the average light transmission (B %) of a wavelength the region of 750-1000nm. With such a lens, since a near infrared ray is removed very alternatively, the visual field that the bad influence to an eye is bright few moreover is acquired.

[0033] Poly diaryl glycol carbonate [ such as methacrylic resin; polycarbonate; polydiethylene glycol bisallyl carbonate, ], such as the polymer which light transmission can be high and can be fabricated as an ingredient of a plastic lens, for example, polymethylmethacrylate etc.,; polystyrene etc. can be illustrated. It excels in transparency and a moldability and the high polycarbonate of a mechanical strength etc. is [ among these ] desirable.

[0034] Since the lens of this invention is a product made from plastics, it is lightweight as compared with a glass lens, and its safety is [ that it is moreover hard to be divided ] high. Therefore, it can be especially used suitably as a glass lens for an eye disease person or old men.

[0035] The plastic lens of this invention can be manufactured by the approach of common use, for example, the following approaches. Namely, (a) Said absorbent is added to a raw material monomer, and it can manufacture by carrying out a polymerization by the cast method etc.

[0036] Moreover, the plastic lens of this invention is (b). It can manufacture also by fabricating the melt of a polymer and said absorbent using predetermined metal mold. In this case, as said polymer, when not spoiling a polymerization reaction, the polymer to which the polymerization of said one sort or two sorts or more of absorbents was added and carried out beforehand can also be used. Although melting temperature changes also with classes of polymer to be used, it is about 150-300 degrees C, for example. Injection molding etc. can perform shaping. Since it is very simple, pressure of business of this approach is carried out as an approach of manufacturing the plastic lens of this invention.

[0037] Furthermore, the plastic lens of this invention is (c). It can manufacture by performing coating to the lens fabricated by the predetermined configuration. Coating can be performed by the approach of common use. By coating, the coat which reflects infrared radiation, and the coat containing said absorbent can be formed. These approaches can be combined two or more and can also be used.

[0038] In case the plastic lens of this invention is manufactured, various additives, for example, a color, a pigment, an antioxidant, a stabilizer, a plasticizer, a polymerization regulator, a remover, etc. may be added.

[0039] Moreover, in order to raise the surface hardness of a lens, the strengthening coat of the lens side may be carried out. The organic strengthening coat (rebound ace court) which makes paint films, such as silicon resin, form in a lens front face is mentioned by dipping a lens into the solution which contains the inorganic strengthening coat which vapor-deposits special glass on

the surface of a lens with a vacuum deposition method, a silicon system compound, etc. as a strengthening coat of a lens side. Especially in the plastic lens of this invention, it is desirable that a rebound ace court is given.

[0040] Moreover, the antifog coat may be given in order that the plastic lens of this invention may prevent that a lens front face blooms cloudy by sweating or the sigh. An antifog coat can be performed by carrying out dipping of the lens into the approach of common use, for example, the solution containing an antifogger.

[0041] As for the plastic lens of this invention, surface treatment, such as acid-resisting processing, chemical-resistant processing, and antistatic treatment, or processing may be performed further again. Moreover, it can also consider as the lens for myopia, or a presbyopia lens by putting whenever into a lens. By using the plastic lens of this invention as a presbyopia lens, it can use suitably as an eye shield for old men with a weak eye.

[0042] It is very useful as the glass lens of business, such as an eye disease person, a sunglass lens, a contact lens, etc. in order to often penetrate a visible ray while the plastic lens of this invention prevents transparency of a beam of light harmful to human being's eyes.

[0043]

[Effect of the Invention] The plastic lens of this invention prevents alternatively transparency of a near infrared ray harmful to human being's eyes, and ultraviolet rays, and penetrates a visible ray with high permeability. Therefore, even if it is a person with weak eyes, such as an eye disease person, neither a burden nor damage is received in an eye, and, moreover, a bright field of view is acquired.

[0044]

[Example] Hereafter, this invention is not limited by these examples although an example explains this invention concretely. In addition, the section expresses the weight section in an example. Moreover, the transparency spectrum of the obtained lens was measured with the spectrophotometer [:[ by Hitachi, Ltd. ] U-3410 mold].

[0045] bisphenol A mold polycarbonate [Teijin which contains example 1 ultraviolet ray absorbent (Riken Vitamin K the product made from K., RIKEMARU S- 100A) 0.1% — Formation — make — with the L-1225L]100 section Dithiol nickel complex salt system near infrared ray absorbent [Dainippon Ink & Chemicals, Inc. make, Melting of the mixture containing the 200] span die IR additive 0.024 section, and a small amount of blue color and a red color was carried out at 250 degrees C, it fabricated with the injection molding machine using predetermined metal mold, and the plastic lens of outer-diameter 75mmphi and 2mm of main thickness was obtained. The measurement result of the transparency spectrum of the obtained lens is shown in drawing 1 .

[0046] \*\*\*\* for the 0.020 sections outside obtained the plastic lens for the same dithiol nickel complex salt system near infrared ray absorbent as example 2 example 1 like the example 1. The measurement result of the transparency spectrum of the obtained lens is shown in drawing 2 .

[0047] The lens obtained in the examples 1 and 2 penetrates a visible ray with very high permeability while preventing effectively transparency of ultraviolet rays and a near infrared ray, so that drawing 1 and drawing 2 may see.

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DESCRIPTION OF DRAWINGS

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## [Brief Description of the Drawings]

[Drawing 1] Drawing 1 is drawing showing the transparency spectrum of the lens obtained in the example 1.

[Drawing 2] Drawing 2 is drawing showing the transparency spectrum of the lens obtained in the example 2.

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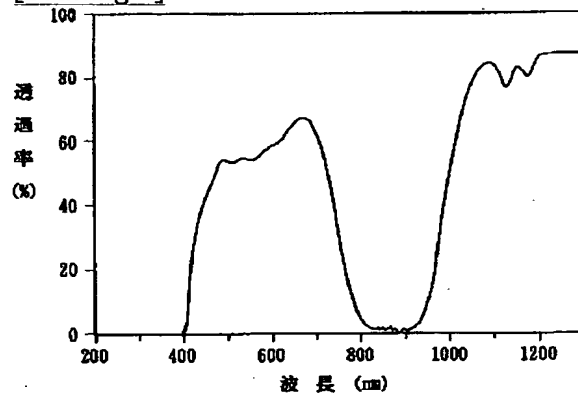
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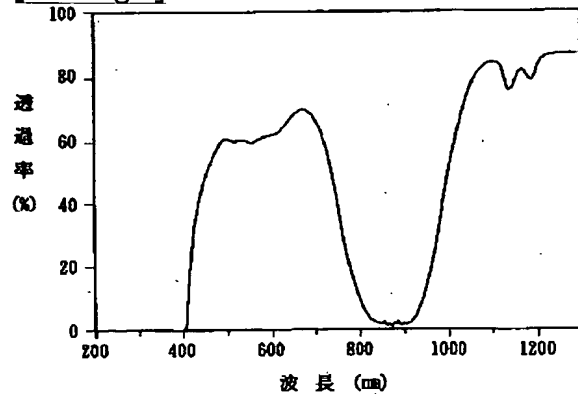
DRAWINGS

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[Drawing 1]



[Drawing 2]





[Translation done.]